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Prevalence and the associated risk factors of bovine trypanosomiasis in nyangatom pastoral woreda, Southern Nation and Nationalities People Region (SNNPR), Ethiopia

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A cross-sectional study was carried out in Nyangatom wereda of South Omo zone, Southern Nation and Nationalities People Region (SNNPR), Ethiopia with the general objectives to find out the prevalence of bovine trypanosomiasis and the risk factors associated with its prevalence from January to June 2015. To identify the protozoa blood samples (n =384) collected from the marginal ear vein of indigenous zebu cattle of more than one year age and both the sexes from three kebeles were examined by buffy coat technique, direct blood smear, thick blood smear and thin blood smear after staining. The overall prevalence of bovine trypanosomaisis was 26.3%. On peasant associations (PA'S) basis Lebere kebele has the highest prevalence 39(30.5%) followed by Shenkora kebele 34 (26.6%) and Ayipa kebele 28 (21.9%). *Trypanosoma congolense* is the most prevalent species (14.3%) followed by *Trypanosoma vivax* (5.70%) and *Trypanosoma brucei* (5.50%). A significant association was observed (P<0.05) between the disease positivity and age, sex and body condition score. The prevalence of trypanosomiasis was 16.20 and 31.50% in young and adult respectively. The prevalence 42.80 and 16.30 % in poor and good body condition score respectively. There was significant association between the risk factors and the species of trypanosomiasis (P<0.05). The result of the present study revealed that trypanosomiasis is the most important problem for animal production in the study area. Strategic control of bovine trypanosomiasis should be strengthened to improve livestock production and agricultural development in the area.

Key words: Bovine, buffy coat, Nyangatom, prevalence, trypanosomiasis.

INTRODUCTION

In Ethiopia, tsetse flies (the vector of different species of *Trypanosoma*)) infest an area of approximately 240,000 km^2; most of this area is located in the southern region of which; 25,000 km^2 is found in the southern rift valley of

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Ethiopia. About 10 to 14 million heads of cattle in Ethiopia, 4 to 6 million heads of cattle in southern region and 2 to 3 million heads of cattle in the southern rift valley are at risk from trypanosomosis.

Trypanosomosis is a complex immunosuppressive disease caused by unicellular, eukaryotic, hetetro specific haemo- parasites (trypanosomes) of blood and other tissues of vertebrates including cattle and man (Uilenberg, 1998; Singla et al., 2009). The disease by flagellated protozoa is transmitted by a number of different arthropod vectors but mainly by biting flies (Kumar et al., 2012; Sharma et al., 2012: Sharma et al., 2015). The disease is coincident with the distribution of the tsetse fly (*Glossina* spp.) and other flies which acts as a vector for the parasite (Sumbria et al., 2015) and infests an area of some 10 million square kilometer encompassing 36 countries in Africa (Black and Seed, 2002).

Trypanosomosis, a disease of major economic importance is caused by several species of trypanosomes, a major constraint to livestock animal production (Urquhart et al., 1996; Aulakhet al., 2005). Pathogenic species of salivarian trypanosomes are present throughout vast areas of Africa including Ethiopia (Jahnke et al., 1988*).* The disease in livestock creates great loses in terms of mortality, abortion, reduced fertility, milk and meat production, and working abilities of animals (Juyal et al., 2005). Depending on the species of *Trypanosoma* the organisms are transmitted cyclically by tsetse flies of the genus *Glossina* or mechanically by tsetse or other biting flies. The disease is the most economically damaging and widely distributed in most parts of Ethiopia (DACA, 2006).

Bovine *trypanosomosis*, which is one of the most important protozoa diseases of cattle in Ethiopia, affects the health status of animals. In general bovine are susceptible to trypanosome infection such as *T. vivax, T. congolese T. brucei* and *T. evansi* (Leak, 1996). Therefore, the objectives of this study were to determine prevalence and risk factors of trypanosomosis in the study area and to identify and define the existing species of *Trypanosom*a in the study area.

MATERIALS AND METHODS

Study area

The study was conducted from January to June/2015 in the Nyangatom woreda, Ethiopia located in south omo zone of SNNPR, comprising of 20 (1 urban and 19 rural) kebele administrations. It is one of the eight woredas in south omo zone with an area of 2652 km and is located at 4.850 to 5.670N and 35.750 to 36.230E. It's bordering with Bench -maji zone and Selamagoworeda in north, Dassenech woreda in south, Hamar woreda in east and Kenya and South Sudan in west (CSA, 2013). The traditional agro ecology of the woreda is kola with an altitude that ranges between 300 and 450 m a.s.l. The mean annual temperature of the woreda ranges between 33 and 42°C. The woreda has a rainfall pattern of bimodal type (Belg from March to May and Meher from August to October). The mean annual rainfall ranges from 350 to 500 mm. Livestock production is the dominant livelihood source in the woreda. It has an animal resource with an estimate of about 415,292 cattle, 132,604 goats, 109217 sheep, 11218 donkeys and 5474 chicken. There are three ethnic groups in the woreda. Nyangatom is the dominant one followed by Murulle and Koygu (Muguji) (SOFEDD, 2012).

Study population

The study population was indigenous zebu cattle of more than one year age group, with poor and good body condition and both sex which are found within three kebeles of the study area. Particularly Lebere, Shenkora and Ayipa. A total of 384 cattle were examined to estimate the existing prevalence rate of trypanosomosis.

Study design and sample size determination

A cross - sectional study was conducted in order to determine the prevalence of bovine trypanosomosis and associated risk factors from selected kebeles of the woreda. The size of sample was determined by the following formula (Thrusfield, 2005) with 95% confidence and an expected prevalence of 50 and at 5% absolute precision. Based on the formula the total sample size was 384.

Sampling procedures

The sampling site (marginal ear vein) of the cattle was prepared and disinfected with ethanol. Then the ear vein was punctured by lancet and the blood sample was collected by heparinized capillary tube. One end of the tube was sealed by crystal seal and finally, the blood samples were immediately transported to jinka, the town of south omo zone, regional laboratory in tightly closed ice box.

Sample processing and examination techniques

Thin blood smear

A small drop of blood from a micro-hematocrit capillary tube was applied to a clean slide and spread by using another clean slide at an angle of 45°. The smear was air dried and then fixed for 2 min in methyl alcohol. The thin smear was flooded with Giemsa stain (1:10 solution) for 30 min. Excess stain was drained and washed by using distilled water. Then it was allowed to dry by standing up right on the rack and examined under the microscope (x100) oil immersion objective lens (OIE, 2008).

Buffy coat technique

Heparinised micro haematocrit capillary tubes, containing blood samples were centrifuged for 5 min at 12,000 rpm. After the centrifugation, trypanosomes were usually found in or just above the buffy coat layer. The capillary tube was cut using a diamond tipped pen 1 mm below the buffy coat to include the upper most layers of the red blood cells and 3 mm above to include the plasma. The content of the capillary tube was expressed onto a glass slide, and covered with cover slip. The slide was examined under x40 objective and x10 eye piece for movement of parasite (Paris et al., 1982). *Trypanosoma* species were identified according to their morphological descriptions on Giemsa stained blood film as well as movement in wet film preparations provided by (Radostitis et al., 2007).

Table 1. Prevalence of trypanosomosis in Nyangatom on basis of peasant associations.

Kebele	No. of positive (%)	No. of negative (%)	P– value
Lebere	39 (30.5)	89 (69.5)	
Shenkora	34 (26.6)	94 (73.4)	0.119
Ayipa	28 (21.9)	100 (78.1)	

Table 2. Species of *Trypanosoma* involved with different risk factors.

Variable		*T. congolense*	*T. brucei*	*T. vivax*	p-value
Age	Adult	46 (18.1%)	13(5.1%)	16 (6.3%)	0.005
	Young	9 (6.9%)	8(6.2%)	6 (4.6%)	
Sex	Male	10 (9.3%)	3(2.8%)	7(6.5%)	0.027
	Female	45 (16.3%)	18(6.6%)	15 (5.4%)	
Body condition	Good	20 (8.9%)	10 (4.2%)	7 (2.9%)	0.000
	Poor	35 (24.1%)	11(7.6%)	15 (10.3%)	
Kebele	Debre	19 (14.8%)	10 (7.8%)	10 (7.8%)	0.192
	Shenkora	20 (15.6%)	7 (5.5%)	4. (3.1%)	
	AyPA	16(12.5%)	4 (3.1%)	8 (6.2%)	
Total		55(14.3%	20(5.5%)	22 (5.7%)	

Table 3. Prevalence of *Trypanosoma* infection in both sexes.

Variable	No. of positive (%)	No. of negative (%)	p-value
Male	20 (18.5%)	88 (81.5%)	0.030
Female	81(29.3%)	195(70.7%)	

Data management and analysis

The data on individual animal and parasitological examination was entered into Microsoft Excel (MS-Excel). These data was analyzed using Statistical Package for Social Science (SPSS version 20.0) software. The descriptive statistics called Pearson Chi-Square test was used to see the association of trypanosomosis infection rates with different variables like age, sex and body condition score statistical significance for categorical data. Throughout the analysis, 95% confidence interval with 5% degrees of freedom ($P < 0.05$) was considered to say statistically significant difference.

RESULTS

Parasitological survey

The result of the survey shows an overall prevalence for trypanosomosisas 26.3% and there was no significant association between the prevalence for trypanosomosis and kebeles.

On Peasant associations basis Lebere has the highest prevalence of 39(30.5%) followed by Shenkora34 (26.6%) and Ayipa 28(21.9%) (Table 1).

Distribution of *Trypanosoma* species

The species of *Trypanosoma* identified by direct smear, buffy coat technique and thin smear showed that *T. congolense* is the most prevalent (55.45%) followed by *T. vivax* (23.76%) and T. brucei (20.8%). There was a significant association between the species of *Trypanosoma* with age, sex and body condition ($p< 0.05$) and there was no significant association between the species of trypanosome with in kebelles ($p>0.05$) (Table 2).

Prevalence for *Trypanosoma* infection in both sexes

During the present survey, from a total of 384 cattle examined 276(71.87%) were females and 108 (28.12%) of them were male animals.

From the females examined, 29.3% were positive for trypanosoma infection while 18.5% of the male animals were found infected. There was significant association between sex and prevalence for *Trypanosomosis* (Table 3).

Table 4. Prevalence for *Trypanosoma* infection in different age groups.

Parameter		No. positive (%)	No. negative (%)	p-value
Age	Adult > 3 years	80 (31.5%)	74 (68.5%)	0.001
	Young 1-3 years	21 (16.2%)	109 (83.8%)	

Table 5. Prevalence for trypanosoma infection in poor and good body conditionin animals.

Parameter		No. positive (%)	No. negative (%)	p-value
Body condition	Good	39 (16.3%)	200 (83.7%)	0.000
	Poor	62(42.8%)	83 (57.2%)	

Prevalence for *Trypanosoma* infection in different age groups

The animals examined were categorized in different age groups as the young (1-3years) and adults (>3 years). The prevalence was 16.2% in young and 31.5%in adult animals. There was significant association between age and prevalence for trypanosomosis ($p<0.05$) (Table 4).

Prevalence for *Trypanosoma* infection in different body condition

The prevalence of trypanosomosis on two body condition groups was seen and the result showed that 42.8% in poor and 16.3% in good body condition. Relatively it was seen that higher proportion of poor body condition cattle were positive than good body condition animals. There was significant association between body conditions and prevalence for trypanosomiasis (p value<0.05) (Table *5*).

DISCUSSION

The overall result of prevalence of the present study (26.3%) was higher than the result of the previous work (12.79%) by Wondwosen et al. *(*2012). The present finding was lower than that registered by Shimelise et al. *(*2005) in the Ghibe valley 40.3% in late rainy and higher than in similar area (19.01%) in dry season by Wondoson (1986) in Bunno and Abiy (2002) in Goro district (19.01%). This may be due to the difference in agro ecology of the study area, prophylactic measure and difference in season. The positivity of trypanosomosis was not significantly different within kebelles of the woreda whereas the positivity of trypanosomosis was significantly variable with age, sex and body condition score of cattle.

In the present study *T. congolense* was predominant species in the study area which may be due to the development of better immune response to *T. vivax* by the infected animal (Leak et al., 1999). The dominancy *of T. congolense* (55.45%) in the present study is comparable with the previous result of Getachew and Jobre (1996) for tsetse infested areas of Ethiopia (66.1%), Afework (2001) at Pawe North west Ethiopia(60.9%), Terzu (2004) in selected sites of southern region (63.4%) and Wodwosen et al. (2012) worked in selected villages of Arbaminch, Ethiopia.

The result of Tewelde et al. (2004) at Kone (75%) and village-1 (93%) settlement area of Ethiopia, Woldyes and Woldeyes and Aboset (1997) at Arbaminch zuria districs (85.2%) and Rowland et al. (2001) in Ghibe valley, South West of Ethiopia (84%) had shown higher prevalence of *T. congolense* than the present finding. These high ratios of *T. congolense* suggest that the major cyclical vector or *Glossina* species are more efficient transmitters *of T. congolense* than *T. vivax* in East Africa (Langridge, 1976).

The distribution of *Trypanosoma* species was not significantly different within kebelles of the woreda whereas the distributions of species were significantly variable with age, sex and body condition score of cattle. The prevalence in adults was higher than the young ones. In the calf group the prevalence was lower which the result of low exposure to the vector was. Conversely in the adult and older age groups of animals the prevalence of *Trypanosoma* infection was higher due to the constant contact existing with the tsetse fly in the field.

The higher prevalence of poor body condition cattle than good body condition animals in the study was also comparable with the result of Wodwosen et al. (2012) in Arbaminch area and Abraham and Tesfaheyw et al. (2012).

Abbreviation: ALC, Annual loss from liver condemnation; **DACA,** Disease Administration and Control Authority; **FAO,** Food and Agricultural Organization; **HAT,** Human African Trypanosomiasis; **P,** Prevalence rate of the disease at the study area; **PA,**

Peasant Association; **SNNPR,** Southern Nation and Nationalities People Region; **SOFEDD,** South Omo zone Finance and Economy Development Department; **STEP,** Southern Tsetse Eradication Program.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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